U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
PB-284 837

Wilson Reservoir
Elko County, Nevada

National Eutrophication Survey, Corvallis, Oreg

Prepared for

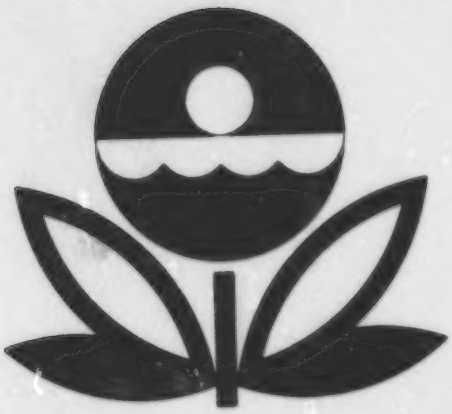
Corvallis Environmental Research Lab, Oreg

Sep 77

PB 284 837

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

45

☆G.P.O. 699-440

Report

on

Wilson Reservoir

Elko County

Nevada

EPA Region IX

Working Paper No. 816

With the cooperation of the

Nevada Environmental Protection Service

and the

Nevada National Guard

September, 1977

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.
3. [illegible] ACCESSION NO.	PB284837
4. TITLE AND SUBTITLE: Report on Wilson Reservoir Elko County, Nevada	5. REPORT DATE: Prepared September 1977
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S): Anonymous (National Eutrophication Survey Staff)	8. PERFORMING ORGANIZATION REPORT NO.: Working Paper # 816
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Environmental Monitoring and Support Laboratory P.O. Box 15027 Las Vegas, Nevada 89114	10. PROGRAM ELEMENT NO.: 1BA029 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS: Office of Research and Development U.S. Environmental Protection Agency 401 M. Street, S. W. Washington, DC 20460	13. TYPE OF REPORT AND PERIOD COVERED: Final 1975 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES
Prepared in cooperation with the U.S. Environmental Protection Agency, Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon 97330

16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading	National Eutrophication Survey Lake Survey	05B 05C

18. DISTRIBUTION STATEMENT: Release Unlimited	19. SECURITY CLASS (This Report): Unclassified	21. NO. OF PAGES: 45
	20. SECURITY CLASS (This page)	22. PR[illegible] MF A01 PC A03

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

REPORT ON WILSON RESERVOIR

ELKO COUNTY, NEVADA

EPA REGION IX

by

National Eutrophication Survey

Water and Land Quality Branch
Monitoring Operations Division
Environmental Monitoring & Support Laboratory
Las Vegas, Nevada

and

Special Studies Branch
Corvallis Environmental Research Laboratory
Corvallis, Oregon

Working Paper No. 816

OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY

September 1977

CONTENTS

	Page
Foreword	ii
List of Nevada Study Lakes	iv
Lake and Drainage Area Map	v
Sections	
I. Conclusions	1
II. Lake and Drainage Basin Characteristics	4
III. Lake Water Quality Summary	6
IV. Nutrient Loadings	12
V. Literature Reviewed	17
VI. Appendices	18

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the States.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Nevada State Environmental Protection Service for professional involvement, to the Nevada National Guard for conducting the tributary sampling phase of the Survey, and to those Nevada wastewater treatment plant operators who provided effluent samples and flow data.

The staff of the Department of Conservation and Natural Resources, Division of Environmental Protection, State Environmental Protection Service provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper Series.

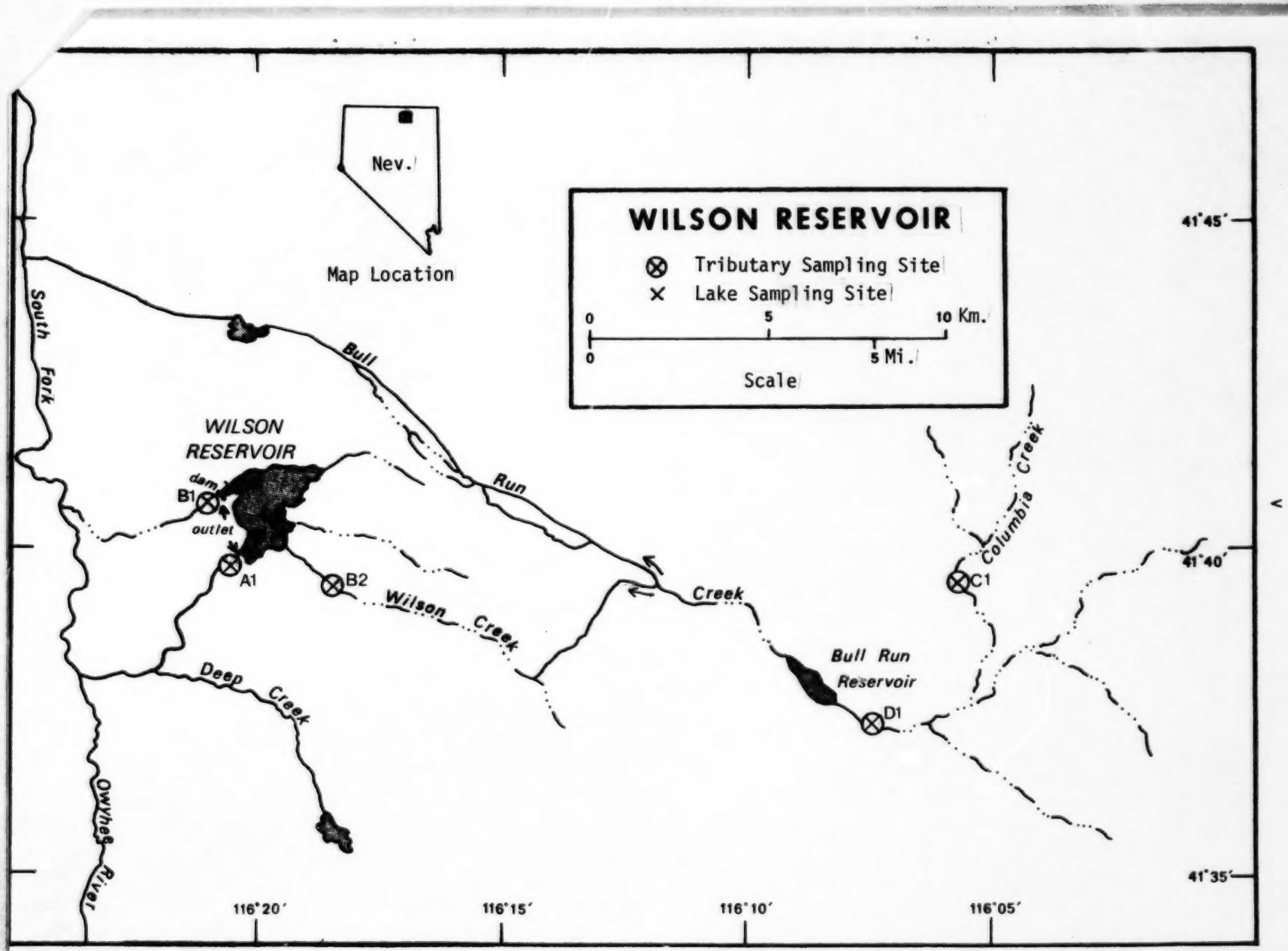
Major General Floyd L. Edsall, the Adjutant General of Nevada, and Project Officer Major Harold E. Roberts, who directed the volunteer efforts of the Nevada National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NEVADA

LAKE NAME	COUNTY
Lake Mead	Clark (Mohave in Arizona)
Lahontan Reservoir	Lyon, Churchill
Rye Patch Reservoir	Pershing
Lake Tahoe	Washoe, Carson City, Douglas (Placer, El Dorado in CA)
Topaz Reservoir	Douglas (Mono in CA)
Upper Pahranagat Lake	Lincoln
Washoe Lake	Washoe
Wildhorse Reservoir	Elko
Wilson Reservoir	Elko
Walker Lake	Mineral


Nev.
Map Location
WILSON RESERVOIR
Tributary Sampling Site
Lake Sampling Site
0
5
10 Km.
0
5 Mi.
Scale
41°45′
41°40′
41°35′
116°20′
116°15′
116°10′
116°05′
South Fork
Bull Run
WILSON RESERVOIR
dam
outlet
B1
A1
B2
Wilson Creek
Deep Creek
Owyhee River
Columbia Creek
C1
Creek
Bull Run Reservoir
D1

REPORT ON WILSON RESERVOIR, NEVADA

STORET NO. 3210

I. CONCLUSIONS

A. Trophic Condition:*

Survey data indicate that Wilson Reservoir is eutrophic, i.e., nutrient rich and highly productive. Whether such nutrient enrichment is to be considered beneficial or deleterious is determined by its actual or potential impact upon designated beneficial water uses of the lake.

Chlorophyll a values in the lake ranged from 1.6 µg/l to 42.6 µg/l with a mean of 10.0 µg/l. The potential for primary productivity as measured by algal assay control yields was high. Secchi disc visibility was reported to be the entire depth of the lake in summer and fall, but spring runoff and snow melt resulted in high sediment-related turbidity during June sampling. Of the 10 Nevada lakes sampled in 1975, 7 had higher median total phosphorus levels (0.049 mg/l), 6 had higher median inorganic nitrogen values (0.120 mg/l), and 7 had higher median orthophosphorus levels (0.016 mg/l) than Wilson Reservoir.

Survey limnologists reported algal blooms during June sampling, and that the lake was filled with water hyacinths during July.

*See Appendix E.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Wilson Reservoir was limited by available phosphorus. The reservoir data suggest primary limitation by nitrogen.

C. Nutrient Controllability:

1. Point sources -

There were no known point sources impacting Wilson Reservoir during the sampling year.

The calculated annual phosphorus loading of 0.21 g $P/m^2/yr$ is greater than that proposed by Vollenweider (1975) as "eutrophic" for a lake with the same mean depth and hydraulic retention time. Unless nonpoint nutrient loading can be reduced through modified land management, Wilson Reservoir can be expected to continue to deteriorate in water quality.

2. Nonpoint sources -

Wilson Creek contributed 79.3% of the total phosphorus load to Wilson Reservoir during the sampling year and ungaged tributaries contributed an estimated 12.1%.

It should be noted that estimations of annual nutrient loadings contributed by septic tanks around Wilson Reservoir may be substantially underestimated. Those U.S. Geological Survey (USGS) quadrangles used for determining the number of shoreline residences located within 100 meters of the lake were dated in the 1960's. Thus, the present number of septic

tanks in the area is not known; neither has it been ascertained if those outside the 100 meter limit (U.S. EPA, 1975) do contribute nutrients to the lake as has been suggested (F. Luchetti, Personal Communication). Additional study to obtain a more accurate picture of the nutrient budget for Wilson Reservoir is recommended.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. Lake morphometry data were provided by James B. Wilson, Jr. (personal communication). Tributary flow data were provided by the Nevada District Office of the U.S. Geological Survey. Outlet drainage area includes the lake surface area. Tributary B-1 is an outlet which does not have regular water flow. The difference between inflow and outflow to the lake is due to water diversion for irrigational purposes. Mean hydraulic retention time was obtained by dividing the lake volume by mean flow of the outlet. Precipitation values are estimated by methods as outlined in National Eutrophication Survey (NES) Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 3.35 km^2.
2. Mean depth: 3.9 meters.
3. Maximum depth: 7.6 meters.
4. Volume: 12.912 x 10^6 m^3.
5. Mean hydraulic retention time: 1,868 days (5.1 yrs)

B. Tributary and Outlet:
(See Appendix B for flow data)

1. Tributaries -

Name	Drainage area (km^2)	Mean Flow (m^3/sec)
B-2 Wilson Creek	208.8	0.26
Minor tributaries and immediate drainage -	28.8	0.01
Total	237.6	0.27
2. Outlets - A-1 Unnamed Stream	240.9	0.08

C. Precipitation:

1. Year of sampling: 39.1 cm.
2. Mean annual: 37.4 cm.

III. LAKE WATER QUALITY SUMMARY

Wilson Reservoir was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations on the lake and from a number of depths at each station (see map, page v). During the last two sampling dates, depth-integrated samples were collected from each station for chlorophyll a analysis and phytoplankton identification and enumeration. During the first and last visits, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 7.0 meters at Station 01, 2.4 meters at Station 02, and 8.2 meters at Station 03. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III-A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll a determinations are included in III-B. Results of the limiting nutrient study are presented in III-C.

WILSON SINK [illegible]
STORET CODE 3210

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER		(6/ 1/75) S*** = 3				(8/ 1/75) S*** = 3				(11/ 6/75) S*** = 3			
	N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	
TEMPERATURE (DEG CENT)													
0.-1.5 M DEPTH	7	9.0- 14.5	12.5	0.0- 1.2	3	22.5- 22.6	22.5	0.0- 0.0	6	5.7- 6.2	5.7	0.0- 1.5	
MAX DEPTH**	3	5.1- 11.2	9.0	0.9- 7.6	3	14.3- 20.0	16.5	2.4- 8.2	3	5.7- 6.2	5.8	1.5- 7.0	
DISSOLVED OXYGEN (MG/L)													
0.-1.5 M DEPTH	7	9.6- 11.1	10.5	0.0- 1.2	3	7.2- 9.4	9.0	0.0- 0.0	5	9.0- 10.4	9.2	0.0- 1.5	
MAX DEPTH**	3	9.4- 10.5	9.5	0.9- 7.6	1	3.6- 3.6	3.6	8.2- 8.2	3	9.0- 9.4	9.2	1.5- 7.0	
CONDUCTIVITY (UMHOS)													
0.-1.5 M DEPTH	7	84.- 100.	100.	0.0- 1.2	3	10.- 12.	11.	0.0- 0.0	6	131.- 170.	131.	0.0- 1.5	
MAX DEPTH**	3	80.- 100.	88.	0.9- 7.6	3	10.- 15.	12.	2.4- 8.2	3	130.- 137.	134.	1.5- 7.0	
PH (STANDARD UNITS)													
0.-1.5 M DEPTH	7	7.0- 10.0	10.0	0.0- 1.2	3	8.9- 9.6	9.4	0.0- 0.0	6	7.6- 8.8	8.6	0.0- 1.5	
MAX DEPTH**	3	8.4- 10.0	10.0	0.9- 7.6	1	8.2- 8.2	8.2	8.2- 8.2	3	8.5- 8.7	8.7	1.5- 7.0	
TOTAL ALKALINITY (MG/L)													
0.-1.5 M DEPTH	7	65.- 82.	71.	0.0- 1.2	3	63.- 79.	64.	0.0- 0.0	6	68.- 85.	72.	0.0- 1.5	
MAX DEPTH**	3	64.- 78.	70.	0.9- 7.6	1	84.- 84.	84.	8.2- 8.2	3	70.- 72.	72.	1.5- 7.0	
TOTAL P (MG/L)													
0.-1.5 M DEPTH	7	0.107-0.149	0.126	0.0- 1.2	3	0.018-0.027	0.020	0.0- 0.0	6	0.032-0.099	0.047	0.0- 1.5	
MAX DEPTH**	3	0.115-0.133	0.129	0.9- 7.6	1	0.027-0.027	0.027	8.2- 8.2	3	0.031-0.099	0.045	1.5- 7.0	
DISSOLVED ORTHO P (MG/L)													
0.-1.5 M DEPTH	7	0.027-0.043	0.033	0.0- 1.2	3	0.006-0.011	0.007	0.0- 0.0	6	0.011-0.064	0.015	0.0- 1.5	
MAX DEPTH**	3	0.027-0.077	0.040	0.9- 7.6	1	0.008-0.008	0.008	8.2- 8.2	3	0.012-0.023	0.014	1.5- 7.0	
NO2+NO3 (MG/L)													
0.-1.5 M DEPTH	7	0.260-0.420	0.350	0.0- 1.2	3	0.020-0.020	0.020	0.0- 0.0	6	0.020-0.430	0.025	0.0- 1.5	
MAX DEPTH**	3	0.260-0.480	0.420	0.9- 7.6	1	0.080-0.080	0.080	8.2- 8.2	3	0.020-0.030	0.020	1.5- 7.0	
AMMONIA (MG/L)													
0.-1.5 M DEPTH	7	0.040-0.060	0.050	0.0- 1.2	3	0.020-0.030	0.030	0.0- 0.0	6	0.020-0.100	0.030	0.0- 1.5	
MAX DEPTH**	3	0.040-0.120	0.060	0.9- 7.6	1	0.040-0.040	0.040	8.2- 8.2	3	0.020-0.030	0.030	1.5- 7.0	
KJELDAHL N (MG/L)													
0.-1.5 M DEPTH	7	0.200-0.800	0.400	0.0- 1.2	3	0.500-0.500	0.500	0.0- 0.0	6	0.200-0.900	0.250	0.0- 1.5	
MAX DEPTH**	3	0.200-0.300	0.300	0.9- 7.6	1	0.400-0.400	0.400	8.2- 8.2	3	0.200-0.900	0.200	1.5- 7.0	
SECCHI DISC (METERS)	3	0.1- 0.2	0.1		3	15.2- 15.2	15.2		0	***** *****	*****		

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** S = NO. OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units Per ml
05/31/75	1. Cryptomonas	1,609
	2. Chroomonas?	623
	3. Nitzschia	260
	4. Synedra	52
	Other genera	---
	Total	2,544
08/01/75	1. Flagellates	210
	2. Gymnodinium	84
	3. Tetraedron	42
	4. Scenedesmus	42
	Other genera	---
	Total	378
11/06/75	1. Pennate diatom	446
	2. Fragilaria	377
	3. Chroomonas?	343
	4. Aphanizomenon	137
	5. Epithemia	69
	Other genera	207
	Total	1,579

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
08/01/75	01	6.7
	02	1.6
	03	2.6
11/06/75	01	3.7
	02	42.6
	03	3.0

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
a. 05/30/75			
Control	0.026	0.375	10.0
0.05 P	0.076	0.375	16.4
0.05 P + 1.0 N	0.076	1.375	29.5
1.00 N	0.026	1.375	10.6
b. 11/06/75			
Control	0.015	0.120	1.6
0.05 P	0.065	0.120	7.0
0.05 P + 1.0 N	0.065	1.120	13.6
1.00 N	0.015	1.120	1.2

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum*, indicate that the potential for primary productivity in Wilson Reservoir was high during both sample collection times (05/30/75, 11/06/75). In both assays, the addition of phosphorus alone and in combination with nitrogen produced a significant increase in yield over that of the control, indicating phosphorus limitation. Spikes of nitrogen alone did not stimulate growth significantly beyond control yields.

The mean inorganic nitrogen to orthophosphorus ratios (N/P) in the lake data of 11/1, 7/1, nad 6/1 in the spring, summer, and fall, respectively, suggest primary limitation by nitrogen (a mean N/P ratio of 14/1 or greater generally reflects phosphorus limitation).

*For further information regarding the algal assay test procedure and selection of test organisms, see U.S. EPA (1971).

IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the Nevada National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of April, May and June when two samples were collected at some stations. Sampling was begun in November 1974, and was completed in October 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Nevada District Office of the USGS for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) were estimated by using the mean annual nutrient loads, in $kg/km^2/year$, in Wilson Creek at Station B-2 and multiplying the means by the ZZ area in km^2.

A. Waste Sources:

1. Known municipal - None
2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
B-2 Wilson Creek	555	79.3
b. Minor tributaries and immediate drainage (nonpoint load) -	85	12.1
c. Known municipal STP's - None		
d. Septic tanks* -	<5	<0.1
e. Known industrial - None		
f. Direct precipitation** -	60	8.6
Total	700	100.0%

2. Outputs - A-1 Unnamed Stream 700

3. Net annual P accumulation - ---

*Estimate based on one lakeshore residence (see nutrient controllability, page 2).
**Estimated (See NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
B-2 Wilson Creek	6,060	57.6
b. Minor tributaries and immediate drainage (nonpoint load) -	835	7.9
c. Known municipal STP's - None		
d. Septic tanks* -	10	0.1
e. Known industrial - None		
f. Direct precipitation** -	3,615	34.4
Total	10,520	100.0%

2. Outputs - A-1 Unnamed Stream 15,490

3. Net annual N export*** - 4,970

*Estimate based on one lakeshore residence (see nutrient controllability, page 2).
**Estimated (See NES Working Paper No. 175).
***Export probably due to unknown sources and/or sampling error.

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Wilson Creek	3	29

E. Mean Annual Nutrient Concentrations in Ungaged Streams:

Tributary	Mean Total P (mg/l)	Mean Total N (mg/l)
C-1 Columbia Creek	0.063	0.600
D-1 Bull Creek	0.096	0.924
1-E Deep Creek*	0.242	1.802

*Special interest stream outside the Wilson Reservoir watershed.

F. Yearly Loadings:

In the following table, the existing phosphorus annual loading is compared to the relationship proposed by Vollenweider (1975). Essentially, his "eutrophic" loading is that at which the receiving waters would become eutrophic or remain eutrophic; his "oligotrophic" loading is that which would result in the receiving water remaining oligotrophic if morphometry permitted. A "mesotrophic" loading would be considered one between "eutrophic" nad "oligotrophic".

Note that Vollenweider's model may not apply to lakes with short hydraulic retention times or in which light penetration is severely restricted by high concentrations of suspended solids in the surface waters.

	Total Yearly Phosphorus Loading ($g/m^2/yr$)
Estimated loading for Wilson Reservoir	0.21
Vollenweider's "eutrophic" loading	0.15
Vollenweider's "oligotrophic" loading	0.08

V. LITERATURE REVIEWED

Luchetti, F. 1977. Personal communication (septic tanks). Nevada Environmental Protection Service, Carson City, Nevada.

U.S. Environmental Protection Agency. 1971. Algal Assay Procedure Bottle Test. National Eutrophication Research Program, Corvallis, Oregon.

U.S. Environmental Protection Agency. 1975. National Eutrophication Survey Methods 1973-1976. Working Paper No. 175. National Environmental Research Center, Las Vegas, Nevada, and Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon.

Vollenweider, R. A. 1975. Input-Output Models With Special Reference to the Phosphorus Loading Concept in Limnology. Schweiz. Z. Hydrol. 37:53-84.

Williams, James B. 1974. Personal communication (lake morphometry). Department of Human Resources, Carson City, Nevada.

VI. APPENDICES

APPENDIX A

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NEVADA 1/21/77

LAKE CODE 3210 *WILSON RESERVOIR

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 240.9

NORMALIZED FLOWS(CMS)

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3210A1	240.9	0.0	0.0	0.014	0.142	0.566	0.255	0.014	0.0	0.0	0.0	0.0	0.0	0.083
321081	240.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
321082	208.8	0.057	0.057	0.142	0.283	1.416	0.850	0.113	0.028	0.028	0.028	0.028	0.028	0.256
321077	32.1	0.006	0.006	0.011	0.028	0.045	0.037	0.011	0.003	0.003	0.003	0.003	0.003	0.013

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 240.9
SUM OF SUB-DRAINAGE AREAS = 240.9

TOTAL FLOW IN = 3.22
TOTAL FLOW OUT = 0.99

NOTE *** A1 INCLUDES 67 SQ. MI. OUTSIDE OF BASIN. PART OF H2O DIVERTED INTO RES.

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3210A1	11	74	0.0	25	0.0				
	12	74	0.0	14	0.0				
	1	75	0.0	18	0.0				
	2	75	0.0	22	0.0				
	3	75	0.0	22	0.0				
	4	75	0.0	12	0.0	26	0.0		
	5	75	4.248	10	2.832	24	16.990		
	6	75	5.663	7	8.495	22	2.832		
	7	75	0.425	19	0.283				
	8	75	0.0	16	0.0				
	9	75	0.0	13	0.0				
	10	75	0.0						
321081	11	74	0.0	25	0.0				
	12	74	0.0	14	0.0				
	1	75	0.0	18	0.0				
	2	75	0.0	22	0.0				
	3	75	0.0	17	0.0	22	0.0		
	4	75	0.0	12	0.0	26	0.0		
	5	75	0.0	24	0.0				
	6	75	0.0	7	0.0	22	0.0		
	7	75	0.0	19	0.0				
	8	75	0.0	16	0.0				
	9	75	0.0	13	0.0				
	10	75	0.0						

TRIBUTARY FLOW INFORMATION FOR NEVADA 1/21/77

LAKE CODE 3210 WILSON RESERVOIR

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
321082	11	74	0.085	25	0.085				
	12	74	0.113	14	0.113				
	1	75	0.198	18	0.198				
	2	75	0.340	22	0.396				
	3	75	0.708	23	0.991				
	4	75	1.133	12	0.991	28	1.699		
	5	75	14.158	10	14.158	24	16.990		
	6	75	5.663	7	8.495	22	2.832		
	7	75	1.416	19	0.708				
	8	75	0.227	16	0.255				
	9	75	0.057	13	0.028				
	10	75	0.085	11	0.071				

APPENDIX C

PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 77/01/26
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

321001
41 39 58.0 116 20 08.0 3
WILSON SINK RESERVOIR
32007 NEVADA

/TYPA/AMBNT/LAKE

11EPALES 751216 04001002
0005 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/06/01	09 00	0000	13.5	10.8	8	84	10.00	74	0.050	0.800	0.300	0.043
	09 00	0003	9.0	9.6		84	9.60	68	0.050	0.400	0.410	0.040
	09 00	0004	9.0	9.8		88	10.00	70	0.060	0.300	0.420	0.040
75/08/01	18 30	0000	22.5	9.0	600	10	9.40	63	0.030	0.500	0.020	0.011
	18 30	0009	20.0			10						
75/11/06	15 00	0000	5.7	9.6		132	8.60	72	0.030	0.200K	0.020	0.016
	15 00	0005	5.7	9.0		131	8.70	73	0.030	0.200K	0.020	0.011
	15 00	0015	5.7	8.8		131	8.60	75	0.040	0.200	0.020	0.012
	15 00	0023	5.8	9.0		134	8.70	72	0.030	0.200	0.020	0.012

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/06/01	09 00	0000	0.141		
	09 00	0003	0.126		
	09 00	0004	0.129		
75/08/01	18 30	0000	0.027	6.7	
75/11/06	15 00	0000	0.036	3.7	
	15 00	0005	0.049		
	15 00	0015	0.029		
	15 00	0023	0.031		

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 77/01/26
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

321002
41 40 06.0 116 19 39.0 3
WILSON SINK RESERVOIR
32007 NEVADA

/TYPA/AMBNT/LAKE

11EPALES 751216 04001002
0004 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/06/01	09 30	0000	12.5	11.0	3	100	10.00	82	0.040	0.500	0.300	0.031
	09 30	0003	11.2	10.5		100	10.00	78	0.040	0.200	0.260	0.027
75/08/01	18 54	0000	22.6	9.4	600	11	9.60	64	0.020	0.500	0.020K	0.007
	18 54	0008	16.5			15						
75/11/06	13 20	0000	5.7	10.4		131	8.75	68	0.020	0.300	0.020	0.011
	13 20	0005	5.7	9.2		137	8.70	72	0.030	0.900	0.030	0.023

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT RFMNING PERCENT
75/06/01	09 30	0000	0.149		
	09 30	0003	0.115		
75/08/01	18 54	0000	0.020	1.6	
75/11/06	13 20	0000	0.032	42.6	
	13 20	0005	0.099		

K VALUE KNOWN TO BE LESS
THAN INDICATED

25

STORET RETRIEVAL DATE 77/01/26
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

321003
41 40 57.0 116 20 41.0 3
WILSON SINK RESERVOIR
32007 NEVADA

/TYPA/AMBNT/LAKE

11EPALES 751216 04001002
0025 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/06/01	10 00	0000	14.5	11.1	5	100	7.50	71	0.040	0.300	0.350	0.031
	10 00	0003	12.6	10.0		100	7.00	65	0.050	0.400	0.400	0.033
	10 00	0010	9.6	7.1		92	7.00	64	0.060	0.300	0.450	0.037
	10 00	0016	7.5			86	8.00					
	10 00	0025	5.1	9.4		80	8.40	64	0.120	0.300	0.480	0.077
75/08/01	19 05	0000	22.5	7.2	600	12	8.95	79	0.030	0.500	0.020K	0.006
	19 05	0019	19.0	7.0		12	9.00	77	0.030	0.500	0.020K	0.006
	19 05	0027	14.3	3.6		12	8.20	84	0.040	0.400	0.080	0.008
75/11/06	14 45	0000	6.2			170	7.60	85	0.100	0.300	0.220	0.064
	14 45	0005	6.2	9.0		131	8.50	70	0.040	0.200	0.430	0.015
	14 45	0015	6.2	9.4		130	8.55	70	0.020	0.200K	0.020	0.014

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/06/01	10 00	0000	0.107		
	10 00	0003	0.116		
	10 00	0010	0.145		
	10 00	0025	0.133		
75/08/01	19 05	0000	0.018	2.6	
	19 05	0019	0.025		
	19 05	0027	0.027		
75/11/06	14 45	0000	0.045	3.0	
	14 45	0005	0.051		
	14 45	0015	0.045		

K VALUE KNOWN TO BE LESS
THAN INDICATED

APPENDIX D

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

[illegible] DATE 77/01/22
ATL + TR[illegible]ICATION SURVEY
FROM LAS VEGAS

3210A1
41 40 40.0 116 20 20.0 4
UNNAMED STREAM
32 15 WILSON RES
O/WILSON RESERVOIR 130791
BRDG ON DRT RD AT S TIP OF WILSON RES
11EMALES 04001004
0000 FEET DEPTH CLASS 00

/TYPE/ASSIST/INFAS

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/05/10	12	15	0.175	0.750	0.020	0.020	0.080
75/05/24	13	25	0.420	0.450	0.035	0.050	0.170
75/06/07	13	05	0.200	0.300	0.025	0.065	0.080
75/06/22	12	35	0.045	0.900	0.030		0.030
75/07/19	11	15	0.010		0.055	0.005	0.020

Reproduced from best available copy.

EUTROPHICATION SURVEY
EPA- LAS VEGAS

/TYPA/AMBNT/STREAM

3210H1
41 39 45.0 116 20 50.0 4
WILSON CREEK
32 15 WILSON RES
0/WILSON RESERVOIR 130791
BNK SAM END OF DRT RD NR TIP OF RES
11EPALES 04001004
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/06/22	12 45		0.045	1.050	0.020	0.010	0.050
75/07/19	12 15		0.005	1.800	0.030	0.140	0.230
75/08/16	13 15		0.010	1.600	0.020	0.200	0.290
75/09/13	14 30		0.010	2.200	0.035	0.160	0.340

STORET RETRIEVAL DATE 77/12/22
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

321082
41 39 20.0 116 18 30.0 4
WILSON CREEK
32 15 WILSON RES
T/WILSON RESERVOIR 130791
BNK SAM FRM JEEP TRAIL 1.5 M SE OF RES
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/TYPA/ANANT/STREAM

DATE FROM TO	TIME OF DAY	DEPT- FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/25	10 45		0.056	0.700	0.020	0.010	0.070
75/04/12	13 20		0.060		0.040	0.010	0.030
75/04/29	12 45		0.770	0.600	0.020	0.050	0.280
75/05/10	12 00		0.610	0.650	0.015	0.045	0.260
75/06/07	13 30		0.140	0.450	0.015	0.025	0.130
75/06/22			0.030	0.850	0.037	0.010	0.040
75/07/19	12 30		0.005	0.750	0.024	0.017	0.020
75/08/16	12 45		0.040	0.225	0.010	0.020	0.045
75/09/13	14 15		0.005	0.200	0.005	0.005K	0.010
75/10/11	12 27		0.080	0.700	0.010	0.005	0.010

K VALUE KNOWN TO BE LESS THAN INDICATED

[illegible]

[illegible]

[illegible]

45 10 01
41 39 30.0 116 08 25.0 4
COLOMBIA CREEK
32 15 BULL RUN
T/WILSON RESERVOIR 130791
SEC RD XING 3.4 MI NE OF BULL RUN CRK
11EPALES 04001004
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/24	13 40		0.024	0.400	0.040	0.005K	0.010K
75/06/07	11 15		0.195	0.400	0.025	0.065	0.130
75/06/22	14 45		0.155	0.600	0.020	0.005	0.120
75/07/19	13 45		0.035	0.650	0.020	0.005	0.030
75/08/16	11 55		0.070	0.150	0.005	0.010	0.040
75/09/13	13 15		0.020	0.800	0.010	0.005	0.020
75/10/11	11 25		0.005	0.700	0.005	0.015	0.040

K VALUE KNOWN TO BE LESS THAN INDICATED

[illegible] DATA RETRIEVAL DATE 77/01/03
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

321001
41 37 15.0 116 07 35.0 4
BULL RUN
32 15 BULL RUN
T/WILSON RESERVOIR 130792
SEC RD XING 4.5 MI NNE OF DEEP CREEK
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/TY-B/AMONI/STREAM

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/24	14 05		0.000	0.300	0.015	0.010	0.010
75/05/24	11 15		0.300	0.750	0.030	0.045	0.210
75/06/07	10 50		0.260	0.800	0.020	0.025	0.280
75/06/22	14 15		0.105	0.550	0.020	0.020	0.100
75/07/19	13 30		0.005	2.100	0.020	0.020	0.060
75/08/16	11 45		0.005	0.300	0.010	0.015	0.050
75/09/13	13 30		0.005	1.200	0.015	0.010	0.020
75/10/11	11 12		0.010	0.700	0.010	0.015	0.040

32

[illegible] SURVEY
[illegible] LAS VEGAS

/TY-A/A IMNT/ST-EAM

sc101s
41 34 00.0 116 05 35.0 4
DEEP CREEK
32 15 BULL RUN
T/WILSON RESERVOIR 130742
BNK SAM OFF DRT RD .3 M ABOV DEEP CREEK
11EPALES 04001004
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/24	14	25	0.010	0.200	0.030	0.045	0.050
74/12/13	11	30	0.190	1.300	0.020	0.055	0.070
75/01/16	14	00	0.024	0.800	0.016	0.065	0.070
75/02/22	15	00	0.010	0.650	0.140	0.005	0.060
75/03/22	11	20	0.095	5.100	0.230	0.185	0.240
75/04/12	12	20	0.750	1.150	0.035	0.130	0.60K
75/04/28	11	50	1.350	2.000	0.050	0.135	0.880
75/05/10	10	55	1.400	1.100	0.045	0.120	0.170
75/05/24	10	50	0.430	2.200	0.025	0.065	0.650
75/06/07	10	30	0.700	1.100	0.015	0.090	0.350
75/06/23	12	00	0.300	1.000	0.020	0.075	0.110
75/07/10	13	15	0.290	2.400	0.050	0.080	0.100
75/04/16	11	26	0.005	0.250	0.005K	0.065	0.090
75/09/13	13	45	0.005	0.700	0.005	0.070	0.090
75/10/11	10	55	0.010	1.000	0.005K	0.060	0.090

K VALUE KNOWN TO BE LESS THAN INDICATED

APPENDIX E

PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1975

STATE OF NEVADA

Mean or median values for six of the key parameters evaluated in establishing the trophic conditions of Nevada lakes sampled are presented to allow direct comparison of the ranking, by parameter, of each lake relative to the others. Median total phosphorus, median inorganic nitrogen and median dissolved orthophosphorus levels are expressed in mg/l. Chlorophyll a values are expressed in µg/l. To maintain consistent rank order with the preceding parameters, the mean Secchi disc depth, in inches, is subtracted from 500. Similarly, minimum dissolved oxygen values are subtracted from 15 to create table entries.

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
3201	LAKE MEAD	0.016	0.340	266.565	3.111	11.400	0.005
3202	LAHONTAN RESERVOIR	0.198	0.350	472.083	4.608	10.400	0.148
3204	RYE PATCH RESERVOIR	0.094	0.050	467.750	4.938	10.000	0.039
3205	LAKE TAHOE	0.005	0.040	-3.269	0.571	10.200	0.003
3206	TOPAZ RESERVOIR	0.057	0.165	376.000	7.517	14.600	0.041
3207	UPPER PAHRANGAT LAKE	0.173	0.125	470.000	---	3.600	0.026
3208	WASHOE LAKE	0.403	0.130	494.555	11.633	7.200	0.268
3209	WILD HORSE RESERVOIR	0.114	0.320	489.400	75.530	14.600	0.065
3210	WILSON RESERVOIR	0.049	0.120	197.333	10.033	11.400	0.016
3211	WALKER LAKE	0.602	0.080	405.333	3.422	15.000	0.574

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
3201	LAKE MEAD	89 (8)	11 (1)	78 (7)	88 (7)	39 (3)	89 (8)
3202	LAHONTAN RESERVOIR	22 (2)	0 (0)	22 (2)	63 (5)	56 (5)	22 (2)
3204	RYE PATCH RESERVOIR	56 (5)	89 (8)	44 (4)	50 (4)	78 (7)	56 (5)
3205	LAKE TAHOE	100 (9)	100 (9)	100 (9)	100 (8)	67 (6)	100 (9)
3206	TOPAZ RESERVOIR	67 (6)	33 (3)	67 (6)	38 (3)	17 (1)	44 (4)
3207	UPPER PAHRANAGAT LAKE	33 (3)	56 (5)	33 (3)	---	89 (8)	67 (6)
3208	WASHOE LAKE	11 (1)	44 (4)	0 (0)	13 (1)	100 (9)	11 (1)
3209	WILD HORSE RESERVOIR	44 (4)	22 (2)	11 (1)	0 (0)	17 (1)	33 (3)
3210	WILSON RESERVOIR	78 (7)	67 (6)	89 (8)	25 (2)	39 (3)	78 (7)
3211	WALKER LAKE	0 (0)	78 (7)	56 (5)	75 (6)	0 (0)	0 (0)